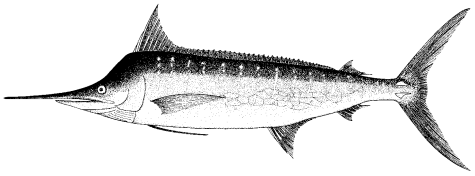
Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien
iotc ctoi



EXECUTIVE SUMMARY: STATUS OF THE INDIAN OCEAN BLUE MARLIN (*MAKAIRA NIGRICANS*) RESOURCE

TABLE 1. Status of blue marlin (*Makaira nigricans*) in the Indian Ocean.

Area[1]	Indicators – 2011 assessment		2011 stock status determination 2010[2]
Indian Ocean	Catch 2010:	11,261 t	Uncertain
	Average catch 2006–2010:	9,508 t	
	MSY (range):	unknown	
	F_{2009}/F_{MSY} (range):	unknown	
	SB_{2009}/SB_{MSY} (range):	unknown	
	SB_{2009}/SB_0 (range):	unknown	

[1]Boundaries for the Indian Ocean = IOTC area of competence
[2]The stock status refers to the most recent years' data used for the assessment.

INDIAN OCEAN STOCK – MANAGEMENT ADVICE

The WPB **AGREED** to the following management advice for the blue marlin resource in the Indian Ocean, for the consideration of the Scientific Committee;

Stock status. No quantitative stock assessment is currently available for blue marlin in the Indian Ocean, and due to a lack of reliable fishery data for several gears, only very preliminary stock indicators can be used. The standardised CPUE suggest that there was a decline in the early 1980s, followed by an increase in abundance over the last 20 years. This contrasts with the majority of non-standardised indicators which suggest a decline in abundance since the 1980s. Therefore the stock status is determined as being *uncertain* (Table 1). However, aspects of species biology, productivity and fisheries combined with a lack of fisheries data on which to base a quantitative assessment is a cause for concern.

Outlook. The decrease in longline catch and effort in recent years has lowered the pressure on the Indian Ocean stock as a whole, however there is not sufficient information to evaluate the effect this will have on the resource.

The WPB **RECOMMENDED** that the Scientific Committee consider the following:

- the Maximum Sustainable Yield estimate for the whole Indian Ocean is unknown.
- annual catches of blue marlin urgently need to be reviewed.
- improvement in data collection and reporting is required to assess the stock.

SUPPORTING INFORMATION

(Information collated from reports of the Working Party on Billfish and other sources as cited)

CONSERVATION AND MANAGEMENT MEASURES

Blue marlin (*Makaira nigricans*) in the Indian Ocean is currently subject to a number of conservation and management measures adopted by the Commission, although none are species specific:

- Resolution 08/04 *concerning the recording of catch by longline fishing vessels in the IOTC area*.
- Resolution 09/02 *On the implementation of a limitation of fishing capacity of contracting parties and cooperating non-contracting parties.*
- Resolution 10/02 *mandatory statistical requirements for IOTC Members and Cooperating non-Contracting Parties (CPC's)*.
- Resolution 10/03 *concerning the recording of catch by fishing vessels in the IOTC area*.
- Resolution 10/08 *concerning a record of active vessels fishing for tunas and swordfish in the IOTC area.*
- Recommendation 11/06 *Concerning the Recording of Catch by Fishing Vessels in the IOTC Area of Competence*.

FISHERIES INDICATORS

General

Blue marlin (*Makaira nigricans*) is a large oceanic apex predator that inhabits tropical and subtropical waters of the Indian, Pacific and Atlantic oceans. Table 2 outlines some key life history parameters relevant for management.

TABLE 2. Biology of Indian Ocean blue marlin (*Makaira nigricans*).

Parameter	Description
Range and stock structure	Little is known on the biology of the blue marlin in the Indian Ocean. Thus, the information detailed here pertains to information from other oceans, primarily the Pacific and Atlantic oceans. Blue marlin is a highly migratory, large oceanic apex predator that inhabits tropical and subtropical waters of the Indian, Pacific and Atlantic oceans. It is known to make regular seasonal migrations (in the Atlantic Ocean) moving toward the equator in winter and away again in summer. In the Pacific Ocean one tagged blue marlin is reported to have travelled 3000nm in 90 days.Blue marlin is a solitary species and prefers the warm offshore surface waters (>24°C); it is scarce in waters less than 100m in depth or close to land.The blue marlin's prey includes octopuses, squid and pelagic fishes such as blackfin tuna and frigate mackerel. Feeding takes place during the daytime, and the fish rarely gather in schools, preferring to hunt alone. No information on stock structure is currently available in the Indian Ocean; thus for the purposes of assessment, one pan-ocean stock is assumed. However, spatial heterogeneity in stock indicators (catch–per–unit–effort trends) for other billfish species indicates that there is potential for localised depletion.
Longevity	~28 years; Females n.a; Males n.a.
Maturity (50%)	Age: 2–4 years; females n.a. males n.a. **Size:** females ~50 cm lower-jaw FL (55 kgs whole weight); males ~80 cm lower-jaw FL (40 kgs total weight).
Spawning season	No spawning grounds have been identified in the Indian oceans. Females may produce up to 10 million eggs. In the Pacific ocean, blue marlin are thought to spawn between May and September off the coast of Japan.
Size (length and weight)	Maximum: Females 430 cm FL; 910 kgs whole weight; males 300 cm FL; 200 kgs whole weight. Young fish grow very quickly in length then put on weight later in life. Sexual dimorphism in size, growth rates and size and age at maturity—females reach larger sizes, grow faster and mature later than males.

n.a. = not available. SOURCES: Nakamura (1985); Cry et al. (1990); Shimose et al. (2008); Froese & Pauly (2009)

Catch trends

Blue marlin are caught mainly under drifting longlines (60%) and gillnets (30%) with remaining catches recorded under troll and hand lines (Fig. 1). Blue marlins are considered to be a bycatch of industrial and artisanal fisheries. The catches of blue marlin are typically higher than those of black marlin and striped marlin combined. In recent years, the fleets of Taiwan,China (longline), Indonesia (longline), Sri Lanka (gillnet) and India (gillnet) are attributed with the highest catches of blue marlin (Fig. 2). The distribution of blue marlin catches has changed since the 1980's with most of the catch now taken in the western areas of the Indian Ocean.

Catch trends for blue marlin are variable; however, this may reflect the level of reporting. The catches of blue marlin under drifting longlines were more or less stable until the mid-80's, at around 3,000 t, steadily increasing since then. The largest catches were recorded in 1997 (~14,000 t). Catches under drifting longlines have been recorded under Taiwan,China and Japan fleets and, recently, Indonesia and several NEI fleets (Fig. 2). In recent years, deep-freezing longliners from Japan and Taiwan,China have reported most of the catches of blue marlin in waters of the western and central tropical Indian Ocean and, to a lesser extent, the Mozambique Channel and the Arabian Sea (Fig. 3).

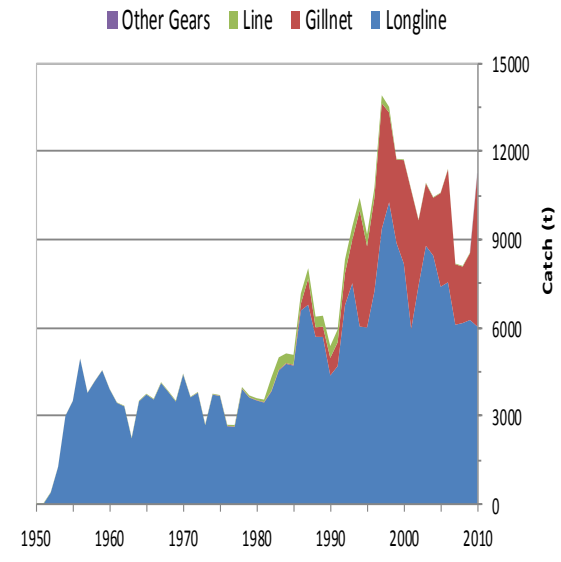


Fig. 1. Catches of blue marlin per gear and year recorded in the IOTC Database (1960–2010).

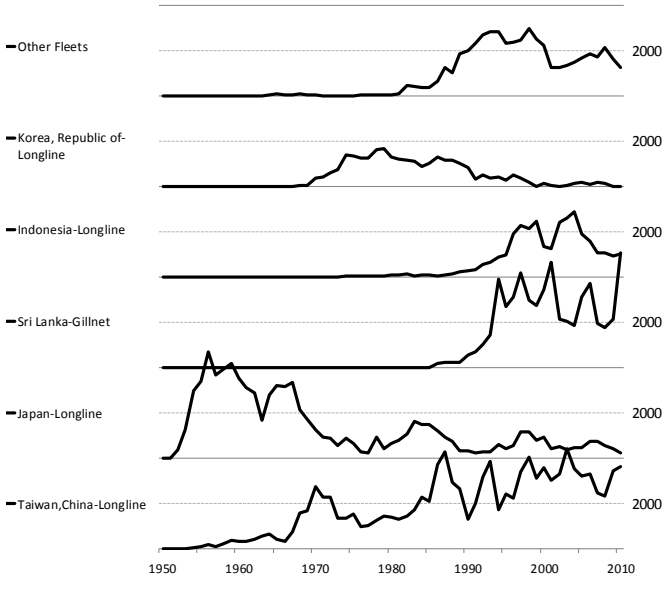


Fig. 2. Catches of blue marlin by fleet recorded in the IOTC Database (1960–2010).

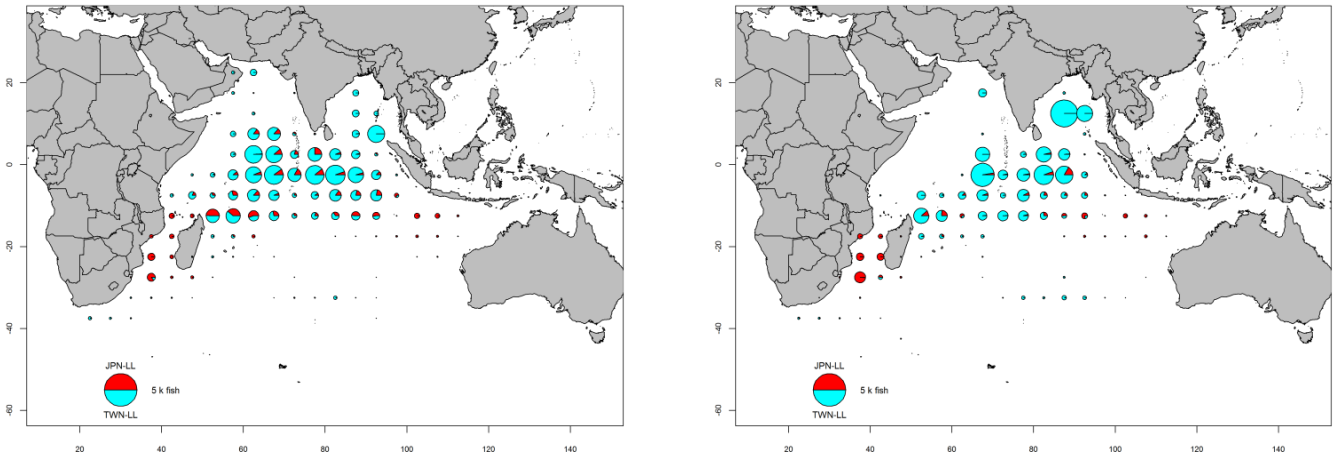


Fig. 3a–b. Time-area catches (in number of fish) of blue marlin as reported for the longline (LL) fisheries of Japan (JPN) and Taiwan,China (TWN) for the 2009 and 2010 by fleet.

TABLE 3. Best scientific estimates of the catches of blue marlin by type of fishery for the period 1950–2010 (in metric tonnes). Data as of October 2011.

Fishery	By decade (average)						By year (last ten years)									
	1950s	1960s	1970s	1980s	1990s	2000s	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Longline	2,563	3,512	3,474	4,961	7,119	8,184	5,949	7,441	8,791	8,457	7,400	7,550	6,106	6,163	6,267	6,043
Gillnet	3	4	10	194	2,407	3,524	4,732	2,219	2,124	1,972	3,188	3,842	2,059	1,921	2,276	5,193
Line	11	23	34	313	341	27	27	26	25	24	17	21	25	26	23	25
Other	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**2,576**	**3,539**	**3,518**	**5,467**	**9,868**	**11,735**	**10,709**	**9,686**	**10,940**	**10,452**	**10,605**	**11,413**	**8,189**	**8,110**	**8,566**	**11,261**

Uncertainty of time–area catches

Minimum catch estimates have been derived from very small amounts of information and are therefore highly uncertain. Difficulties in the identification of marlins also contribute to the uncertainties of the information available to the Secretariat.

Retained catches are poorly known for most fisheries (Fig. 4) due to:

- catch reports often refer to total catches of all three marlin species combined; catches by species are estimated by the Secretariat for some artisanal (gillnet/longline fishery of Sri Lanka and artisanal fisheries of India, Iran and Pakistan) and industrial (longliners of Indonesia and Philippines) fisheries
- catches of non-reporting industrial longliners (India, NEI) and the gillnet fishery of Indonesia are estimated by the Secretariat using alternative information
- catches are likely to be incomplete for industrial fisheries for which the blue marlin is not a target species
- conflicting catch reports: Longline catches from the Republic of Korea are reported as nominal catches, and catch and effort reports are conflicting, with higher catches recorded in the catch and effort table. For this reason, the Secretariat revised the catches of blue marlin for the Republic of Korea over the time-series using both datasets. Although the new catches estimated by the Secretariat are thought to be more accurate, catches of blue marlin remain uncertain for this fleet.
- a lack of catch data for most sport fisheries.
- discards are unknown for most industrial fisheries, mainly longliners. Discards of blue marlin may also occur in the driftnet fishery of I.R. Iran, as this species has no commercial value in this country.

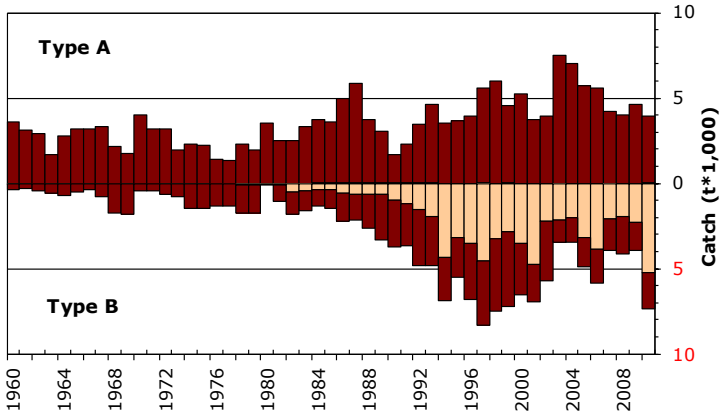


Fig. 4. Uncertainty of time-area catches for blue marlin (Data as of October 2011).
Catches below the zero-line (Type B) refer to fleets that do not report catch-and-effort data to the IOTC, do not report catch-and-effort data by gear and/or species or any of the other reasons provided in the document. Catches over the zero-line (Type A) refer to fleets for which no major inconsistencies have been found to exist. Light bars represent data for artisanal fleets and dark bars represent data for industrial fleets.

Effort trends

Total effort from longline vessels flagged to Japan, Taiwan,China and EU,Spain by five degree square grid from 2007 to 2010 are provided in Fig. 5, and total effort from purse seine vessles flagged to the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags), and others, by five degree square grid and main fleets, for the years 2007 to 2010 are provided in Fig. 6.

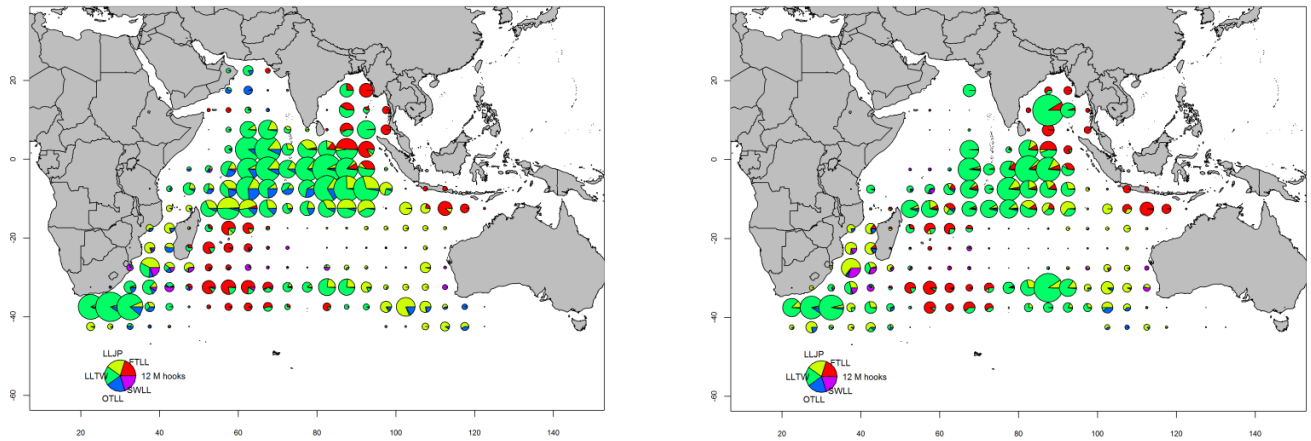


Fig. 5. Number of hooks set (millions) from longline vessels by five degree square grid and main fleets, for the years 2009 (left) and 2010 (right) (Data as of August 2011).
LLJP (light green): deep-freezing longliners from Japan
LLTW (dark green): deep-freezing longliners from Taiwan,China
SWLL (turquoise): swordfish longliners (Australia, EU, Mauritius, Seychelles and other fleets)
FTLL (red) : fresh-tuna longliners (China, Taiwan,China and other fleets)
OTLL (blue): Longliners from other fleets (includes Belize, China, Philippines, Seychelles, South Africa, Rep. of Korea and various other fleets)

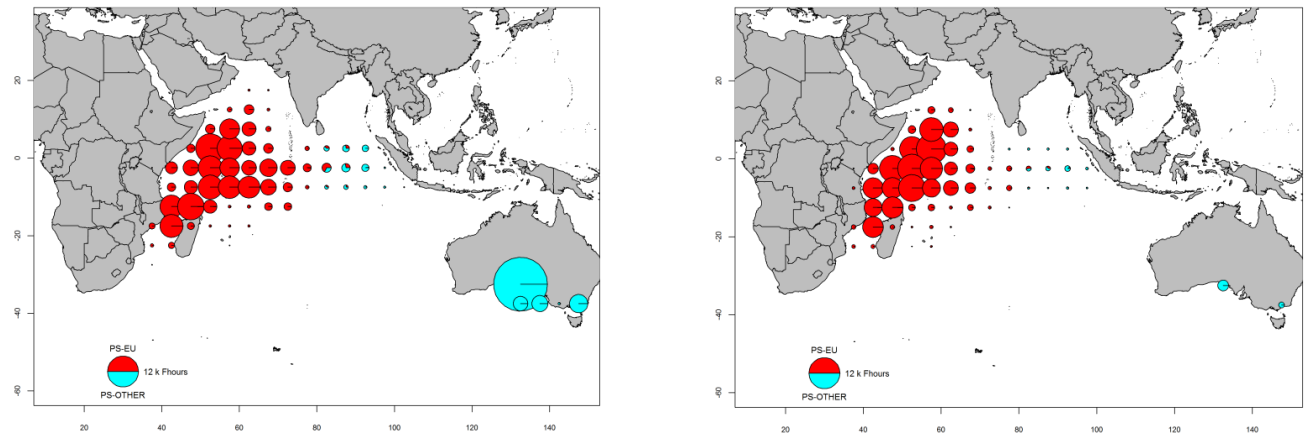


Fig. 6. Number of hours of fishing (Fhours) from purse seine vessels by 5 degree square grid and main fleets, for the years 2009 (left) and 2010 (right) (Data as of August 2011).
PS-EU (red): Industrial purse seiners monitored by the EU and Seychelles (operating under flags of EU countries, Seychelles and other flags)
PS-OTHER (green): Industrial purse seiners from other fleets (includes Japan, Mauritius and purse seiners of Soviet origin) (excludes effort data for purse seiners of Iran and Thailand)

Catch–per–unit–effort (CPUE) trends

A CPUE standardisation of blue marlin (Makaira mazara) caught by the Taiwan,China longline fishery in the Indian Ocean was considered in 2011. The results reveal similar trends of CPUE standardized based on three combinations of fishing areas definitions and data period.

The standardised CPUE for the whole Indian Ocean suggest that there was a decline in the early 1980s, followed by an increase in abundance over the last 20 years (Fig. 7). However, it was also noted that this contrasts with the majority of non-standardised indicators which suggest a decline in abundance since the 1980s (Figs. 8 and 9).

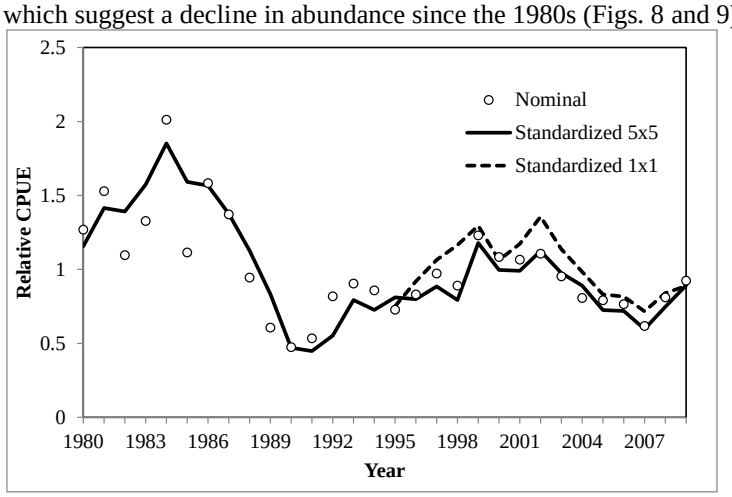


Fig. 7. Area-aggregated nominal and Standardised CPUE of blue marlin caught by Taiwan,China longline fleet based on four fishing areas.

Fig. 8. Nominal CPUE (number of fish by 1,000 hooks) of blue marlin caught by Japanese longliners off-Somalia.

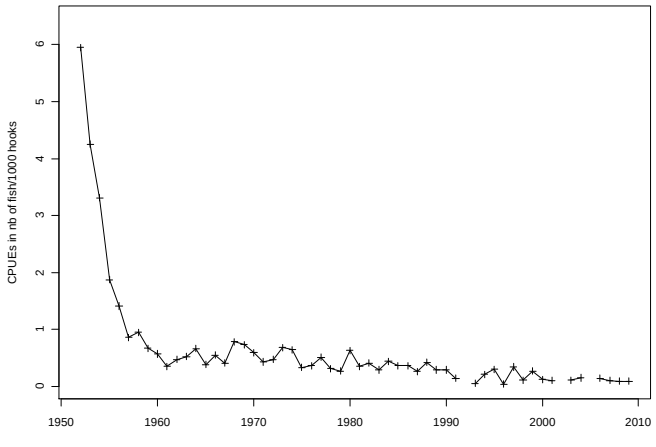


Fig. 9. Nominal CPUE (number of fish by 1,000 hooks) of blue marlin caught by Japanese longliners northwest Australia.

Fish size or age trends (e.g. by length, weight, sex and/or maturity)

Average fish weight can only be assessed for the longline fishery of Japan since 1970 and Taiwan,China since 1980. The number of specimens measured on Japanese longliners in recent years is, however, very low.

Catch-at-Size(Age) tables have not been built for blue marlin due to a lack of information reported by CPCs. Fish size is derived from various length and weight information, however the reliability of the size data is reduced when relatively few fish out of the total catch are measured.

Sex ratio data have not been provided to the Secretariat by CPCs.

STOCK ASSESSMENT

No quantitative stock assessment for blue marlin in the Indian Ocean is known to exist and no such assessment has been undertaken by the IOTC Working Party on Billfish. However, a preliminary estimation of stock indicators was attempted on the longline catch and effort datasets from Japan and Taiwan,China that represent the best available information (described above). However, there is considerable uncertainty about the degree to which these indicators represent abundance as factors such as changes in targeting practices, discarding practices, fishing grounds and management practices are likely to interact in the depicted trends. Further work must be undertaken to derive additional stock indicators for this species, because in the absence of a quantitative stock assessment, such indicators represent the only means to monitor the status of the stock and assess the impacts of fishing.

TABLE 4. Blue marlin (*Makaira nigricans*) stock status summary.

Management Quantity	Aggregate Indian Ocean
2010 catch estimate (1000 t)	11.3
Mean catch from 2006–2010 (1000 t)	9.5
MSY (1000 t) (80% CI)	unknown
Data period used in assessment	–
F_{2010}/F_{MSY} (80% CI)	–
B_{2010}/B_{MSY} (80% CI)	–
SB_{2010}/SB_{MSY}	–
B_{2010}/B_{1980} (80% CI)	–
SB_{2010}/SB_{1980}	–
$B_{2010}/B_{1980,\ F=0}$	–
$SB_{2010}/SB_{1980,\ F=0}$	–

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